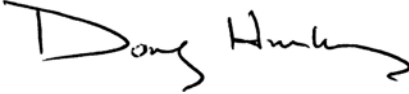




TRANSPORTATION PERFORMANCE AUDIT BOARD

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To: Legislative Transportation Committee
House Transportation Committee
Senate Highways and Transportation Committee

From: Doug Hurley, Chair 

Date: December 17, 2004

Subject: Transmittal of Performance Measure Review Report
WSDOT Highways and Ferries Programs

Assessing the Performance Measurement Systems of several key transportation agencies was the first assignment the Washington State Legislature (the Legislature) gave to the Transportation Performance Audit Board (TPAB). The largest of the agencies whose Performance Measurement System was to be reviewed is the Washington State Department of Transportation (WSDOT). This letter summarizes that review.

The statements in this letter are based on a number of sources and experiences. First, we have heard reports on several occasions from WSDOT staff on the status of their performance measurement and benchmark systems. Second, we have had access to the WSDOT's Gray Notebook and the materials on the WSDOT Accountability website. Third, as a body of citizens with transportation experience and legislators with experience overseeing transportation, we bring perceptions and experiences from those external activities consistent with the legislation that appointed us. Fourth, we contracted with a consultant to conduct a Performance Measurement Review whose report we have read, challenged, and been challenged by.

From the multiple sources referenced above, we have findings that assess both the evolving progress of WSDOT's performance measurement system, and, to a limited degree, point to substantive issues that the current performance reports bring to the surface.

Please note that, unless otherwise specified, page references below refer to the consultant's report which, because of its size, is not included in this document. This letter, its attachments, the complete consultant's report, and WSDOT's comments are available online on the TPAB website at: http://ltc.leg.wa.gov/tpab/pmr_wsdot_hf/pmr_wsdot_hf.htm

BACKGROUND

1. In November 2000, the Governor-appointed Blue Ribbon Commission on Transportation's (BRCT) Benchmark Committee published its final report for Washington State. The report recommended eleven benchmarks for Washington's transportation system and a set of topics for additional benchmarks for future development.

2. In January 2001, the Washington State Transportation Commission analyzed the application of the BRCT benchmarks, and agreed to pursue the development of a performance measurement program for WSDOT. The appointment of Doug MacDonald as the new Secretary of Transportation in April 2001 reinforced this direction.
3. In October 2001, the Transportation Commission formed a Benchmark Committee to develop and guide the use of benchmarks for WSDOT, working with the new Secretary and WSDOT staff. The committee proceeded to develop and implement benchmarks and performance measures for the major policy categories recommended by the BRCT.
4. Beginning in May 2001, WSDOT has published policy goal benchmarks on a quarterly basis in "Measures, Markers, and Mileposts," commonly referred to as the "Gray Notebook," on the WSDOT accountability web page at:
<http://www.wsdot.wa.gov/accountability/default.htm>
5. In January 2002, the Legislature passed ESHB 2304. Codified as RCW 47.01.012 in July 2002, the legislation established transportation benchmark categories and directed the Washington State Transportation Commission to act as a single point of contact to "establish performance measures to ensure transportation system performance at local, regional, and state government levels."
6. On August 20, 2003, in accordance with the categories established by the Legislature, the Washington State Transportation Commission adopted a set of benchmarks for measuring the performance of the state's transportation system. These benchmarks are summarized in the "Transportation Benchmarks Implementation Report" on the WSDOT web site at:
<http://www.wsdot.wa.gov/accountability/benchmarks/BenchmarksImplementationReport.pdf>
7. In 2003, the Legislature created the TPAB, and in RCW 44.75.070, established criteria for performance measurement reviews to be conducted by TPAB. Consistent with those criteria, in reviewing WSDOT, TPAB asked the consultant to address the following questions:
 - Have the Legislature and the Transportation Commission established clear mandates, strategic plans, mission statements, and goals and objectives?
 - Are the performance and outcome measures of WSDOT's Highways and Ferries programs consistent with legislative mandates, Transportation Commission policies, strategic plans, mission statements, and goals and objectives?
 - Have the WSDOT's Highways and Ferries programs established clear performance benchmarks and/or standards for assessing overall performance of the WSDOT?
 - How are WSDOT's management and the Transportation Commission using performance measurement data to improve WSDOT's organization, budget planning, and allocation of resources?
 - Are WSDOT's current reporting requirements contributing to the efficiency of the Department and are they cost effective?
 - Are the "Gray Notebook" and associated quarterly reports to the Transportation Commission meaningful, cost effective tools?

- Are WSDOT's reports being utilized by their targeted user groups?
- How are the WSDOT's Highways and Ferries programs using performance and outcome measures to manage resources in an efficient and effective manner?
- What performance benchmarks have been used in other states to measure the performance of transportation agencies? How do they compare with those used by WSDOT?
- Is WSDOT's information technology capability adequate to provide management information necessary to monitor performance data?

FINDINGS

WSDOT's Evolving Performance Measurement System

1. TPAB finds, in accordance with the report from the consultant, that under the leadership of Secretary Doug MacDonald, the Washington State Department of Transportation (WSDOT) has established and is in the process of implementing an effective system of performance measurement to manage and provide accountability for delivery of products of services. TPAB notes that, had we conducted this review four years ago, there would have been virtually no systematic performance measurement system to assess. The fact that such a system has been put in place in such a short time in an organization of the size and complexity of WSDOT is a remarkable accomplishment in itself and deserves to be recognized.
2. TPAB finds, in accordance with the information provided by our consultant and staff observation of WSDOT's leadership role in the Transportation Research Board's 2004 "Second National Conference on Performance Measures to Improve Transportation Systems," that WSDOT's implementation of performance measurement compares favorably to best practices utilized in other states' Departments of Transportation.
3. TPAB finds, in accordance with the information provided by our consultant and personal observation, that WSDOT uses performance measures to "provide leadership, set direction, establish a performance-oriented culture, and ensure manager accountability in a highly effective way." Managers know what measures are measured, what management expects, and actively express awareness of the measurements as key issues that effect the way they operate. Examples from the consultant's report include:
 - a. The Performance Appraisal System — (page 18) *"From the top down, WSDOT managers establish performance plans with their direct reports. These performance plans specify performance goals, objectives, performance measures, strategies, and actions to accomplish them. With the recent civil service reform and the implementation of the state's new human resource management system, WSDOT is instituting a new employee performance and appraisal system that will align employee performance management with WSDOT's performance measurement system."*
 - b. Project Delivery Meetings — (page 37) *"WSDOT conducts quarterly project delivery meetings that involve senior management meeting in each region with the respective project engineers for project status reports. These meetings identify leadership interventions that can be taken to address*

project risks. Their agenda is driven by project status against performance measures reported in the Gray Notebook."

4. TPAB finds, in accordance with the information provided by our consultant, WSDOT staff presentations, and personal observation that the performance measurement system is still evolving and has achieved different levels of completion in different areas. In some cases, implementation is very complete. "Across all major program areas, measurement is in place to track the delivery of products and services." (pages E-4, 27)

- a. Project Delivery (Page 25) — *"The emphasis in WSDOT's performance measurement system is on providing accountability for the delivery of agreed products and services. For example, the Gray Notebook beginning with the 10th edition provides detail on a project by project basis for projects funded under the 2003 Transportation Funding Package. In addition, at the project level, individual project detail is now provided at the WSDOT Web site. This is reinforced by the personnel performance management system by which, from the top down in the organization, managers' performance plans, the delivery of products and services in budget and on schedule."*
- b. Project Delivery (page 37) — *"Project specific performance measurement provides very direct accountability across the organization. Region administrators, through their performance plans, are directly accountable for the on schedule delivery of projects. Region administrators' direct reports have similarly clear delivery expectations in their performance plans."*
- c. Effective Measurement (Page 32) — *"Program area managers responsible for pavement management, bridge management, safety, and other programs use performance measurement intensively at WSDOT. In each of these areas, there is a sophisticated use of data for the management analysis of how specific improvements meet overall program objectives. For example, pavement performance objectives are tracked and assessed at the system and technical analysis defines the types of pavement improvement that will provide the most cost effective way for preserving the system."*
- d. Improvement Suggested (Page 53) — *"Equipment and facilities offices are in different stages of developing performance measuring systems. The equipment and facilities office uses many performance measures to determine equipment utilization and delivery of facilities but there are no goals specified from which to assess effectiveness."* The report went on to identify specific areas where improvement was indicated. WSDOT has reviewed and concurs with this finding as a needed area of improvement.

5. TPAB finds, in accordance with the information provided by our consultant, that WSDOT and WSF management are using performance measures to manage resources and improve services to customers.

- a. (Page 42) — Highway Maintenance — *"The use of performance measurement to manage and report on effectiveness is well developed for highway maintenance through MAP and is consistent with WSDOT Strategic Plan."*
- b. (Page 70) — Ferry Terminal Scheduling — *"Performance measures are used extensively throughout the management process of scheduling terminal staff."*

- c. (Page 72) — Ferry Maintenance — *“WSF’s new maintenance management system is improving the measurement of efficiency, i.e. the inventory and labor required to accomplish maintenance jobs. Over time, the maintenance management system should also generate the data required to improve effectiveness, i.e. the number and frequency of jobs that must be done.”*

Mandates, Benchmarks, & Measures

TPAB finds that WSDOT has taken the issue of performance measurement and benchmark development very seriously. The most public evidence of this is in the publication of the Gray Notebook. Another indication is in the considerable attention given to the detailed development of benchmarks. As noted above, the Benchmarks Implementation Report can be found online on WSDOT’s web site. It provides a thoughtful and detailed discussion of the various benchmarks proposed by the Blue Ribbon Commission and adopted by the Legislature, the appropriateness of some, the awkwardness of others, and describes the efforts being made by WSDOT to improve upon both the content of and the measurement of benchmarks.

TPAB finds that legislative mandates appear throughout transportation legislation. There appears to be an evolving effort to align instructions from these multiple sources with the benchmarks, business plans and budgets of the agency. Although there is significant emphasis on benchmarking and performance measurement, state government can make significant improvements in aligning the planning and budgeting process with benchmarking and performance management, likely making it more efficient and less time-consuming. Differing formats and overlaps in information often result in duplication of effort and a need to manipulate data in order to make it “fit” a particular planning or reporting requirement.

TPAB finds, as a result of the review, the consultant’s report, and the related discussions, that benchmarks and performance measures are iterative and must continue to evolve over time. WSDOT and the Transportation Commission have initiated a process for establishing and identifying benchmarks. As benchmarks and measures that more accurately reflect the state of the transportation system are discovered, WSDOT, the Transportation Commission and the Legislature should have a common and cohesive system for revising them.

Transportation benchmarks have developed to the point that there is a basis for them to evolve in several areas including roadway conditions, safety, congestion, air quality, and cost effectiveness. In air quality, we note that the benchmarks address traditional pollutants, but could be expanded to include carbon dioxide and diesel particulates. In congestion, although difficult, ways to assess the congestion condition and the contribution to its relief made by different transportation tools can be developed further. In roadway conditions, WSDOT has found, and TPAB concurs, that disaggregating road condition information by type of road has improved the policy utility of the benchmark. Similar disaggregation has helped in safety. The Blue Ribbon Commission did not suggest specific cost effectiveness measures, but noted the need for them to be developed. The evolving skill of WSDOT’s performance measurement efforts will allow the agency to address cost effectiveness measures successfully in the future.

One of the difficulties in establishing benchmarks and measures is that an agency can be judged against established benchmarks and measures for which it has not been adequately funded. Likewise, in agencies with long-term capital programs, decisions about policy involve measuring and predicting future conditions. Benchmarks that measure only the present have limited value to support such long-term policy development.

Communications to Internal and External Customers

Compared to information available several years ago, WSDOT now captures and generates a vast amount of performance and accountability data in printed and electronic form.

Internally, the information is used effectively throughout the management cycle as described in the Dye report on page E-7. *"The reports are a cost-effective mechanism for reporting on WSDOT activities. The Gray Notebook incorporates measurement and other information from WSDOT's management and oversight processes. The reports, particularly those regarding project performance, are used by the commission to provide oversight and ensure accountability.... with regard to internal WSDOT uses and by the commission. The commission uses the reports and finds them extremely valuable."*

The process of preparing a Gray Notebook for publication also serves as an opportunity within the agency for managers and employees to meet and discuss performance measures and their importance, and to reinforce them as part of the agency culture.

Reports are also used by managers as a focus for discussion and policy emphasis. (Page 50) *"...managers interviewed in the regions indicated that maintenance employees are addressing safety concerns and this is resulting in fewer accidents. Regions report on their accountability scorecards the number and cause of accidents on a semi-annual basis. These reports include historical data and expected targets on reportable injuries by year. For example, the south central region reported through June 2004, 23 reportable injuries compared to the state average of twenty-five in a six month period."*

The external focus of WSDOT's communications effort is primarily through the quarterly "Gray Notebook" and the WSDOT web site's accountability page. In the Gray Notebook and on the web, as opposed to raw data that tells "what is", WSDOT emphasizes using the data to "tell a story" and explain "why it is," making the information more tangible to the public. WSDOT's efforts in this area were recently highlighted at the Transportation Research Board's 2004 "Second National Conference on Performance Measures to Improve Transportation Systems."

While WSDOT's performance measurement data is indexed in reasonably adequate ways, its sheer volume and complexity creates communication challenges. Opinion leaders or policy makers may not always be able to easily find what they are looking for, but it is usually not for a lack of information. In response to comments that the Gray Notebook provides too much information, WSDOT has already created a condensed version, the "Gray Notebook Lite," intended as a more accessible and easy-to-read resource. Although available only in printed form at the time of the review, WSDOT has now deployed the Gray Notebook Lite on the WSDOT web site.

WSDOT's communication efforts are heavily dependent on data input to and stored on the agency's information technology systems. Where these fall short (see below) the time and effort required to manipulate the data to communicate it, and the resulting chance of error, are magnified.

In addition to the Gray Notebook and the accountability web site, at the time of the review, WSDOT was required to produce more than 80 reports for outside entities, including the Legislature and, to a large extent, the federal government. These reports are highlighted on page 21 and 22 of the consultant report. In addition, a summary of those reporting requirements prepared for TPAB by WSDOT is conveyed to the Legislature along with the consultant report, and is available online at:

http://lrc.leg.wa.gov/tpab/pmr_wsdot_hf/WSDOT_Reporting_Requirements_final.pdf

Institutional Issues

Information Technology

Performance measurement systems rely on a level of data development, management, and analysis that is far more intensive than traditional governmental reporting techniques. As a result, the adequacy and timeliness of information technology systems plays a pivotal role in the quality of the performance measurement system and its usefulness to internal and external customers. WSDOT recognizes the limitations their systems place on the performance management process and has requested assistance in upgrading and replacing them. In the 2003-05 Transportation budget, the Legislature recognized the need to improve WSDOT's legacy systems and appropriated funds for a strategic assessment of WSDOT's IT systems. Unfortunately, the Legislature could not agree on the department's proposal to begin the assessment process, and the study did not take place.

If WSDOT is to depend on accurate and timely performance data to drive its management decisions and priorities, the data design, software applications, business rules, and computer hardware should support, and not hinder, the process. TPAB finds WSDOT is doing an impressive job with what it has to work with, but limitations in the systems make the process extremely inefficient and require too much manual manipulation of data to achieve the results. Such hand work also provides the opportunity for errors and for those errors to be carried forward and affect other data.

RECOMMENDATIONS

Mandates, Benchmarks, and Measures

TPAB recommends the current edition of the Washington Transportation Plan be used (1) to organize all potential mandates as stated in various pieces of transportation legislation and connect them to the legislatively mandated benchmark categories, (2) to review, adjust, and improve the benchmarks, and (3) to communicate the results as the overarching performance goals of the Washington State transportation system.

We recommend that WSDOT's performance measures be organized under the benchmark categories they support. If relevant measures are discovered that do not support an existing benchmark, such discovery should precipitate development of a new general benchmark, or call the measures' usefulness into question.

We recommend that the WSDOT staff, the Transportation Commission and the Legislature align the budgeting process to the benchmarks so that the Legislature is consciously "buying" given levels of accomplishment.

- WSDOT and the other implementation agencies in the transportation system cannot be held responsible for doing that which they are not funded to do. We recommend that WSDOT and the Legislature consider adopting "revenue adequacy" benchmarks so that it becomes clear "how much" performance has been and will be achieved at given investment levels.
- We recommend that the benchmarking process develop a "predicted future" component to assist in supporting long-term policy and capital project development.
- We recommend that benchmarks and measures develop a "cost-effectiveness" component. This is an area that is of high interest to the public and could be a useful communication tool.

TPAB recommends benchmarks and measures evolve in several areas including roadway conditions, safety, congestion, and air quality. In air quality, we recommend expanding the benchmark list of pollutants to include non-traditional pollutants such as carbon dioxide and diesel particulates. In congestion, we recommend further development of measures to assess the congestion condition and the contribution to its relief made by different transportation tools. Where appropriate, we recommend continuing the disaggregation of benchmark information to improve its utility.

Communicating Accountability and Performance Measurement

As noted above, WSDOT is considered a national leader in its communication of information. Given the excellent data that has been developed and WSDOT's commitment to accountability, TPAB concurs in the final report's Recommendation #3 related to communication of performance related information, and recommends that WSDOT continue to seek ways to make its performance data more accessible to policy makers and the public. In doing so, however, we do not recommend WSDOT compromise the quality of the Gray Notebook, only seek ways to improve its usability.

TPAB recommends that the annual reporting of benchmarks by WSDOT, currently in the July Gray Notebook, also be pulled out and presented as a stand alone report with broad public dissemination. To be effective, it will need to be done as is the Gray Notebook in general, as a story telling device. A key to its effectiveness will be the provision of trend lines of performance over time.

Institutional Recommendations

Information Technology

The TPAB concurs in Recommendation #4 as relates to WSDOT's information technology infrastructure and systems. TPAB recommends the Legislature again approve and fund a strategic assessment study of WSDOT's IT systems, and further recommends that the agency work closely with select transportation committee members and staff to address concerns that blocked the process in the past.

The Governor and OFM, the Legislature, the Transportation Commission and WSDOT

Benchmarks and performance measures are well and good as long as they are part of the natural organic life of not only WSDOT itself, but also the agencies that oversee WSDOT. Legislative bodies may well pass laws that require benchmarks and performance measures, but as the late Seattle City Councilmember Sam Smith said of his nine-member body to staffers who pressed policy objections to his proposals, "Five votes make policy." And so it should be in a representative democracy.

The tension between "five votes" and the rational imperatives of benchmarks, performance measures, Priorities of Government (POG) and the like is inevitable. However, in learning that TPAB was the 82nd reporting requirement for the WSDOT, we were struck by the sheer volume of the reporting. Later, we learned more about POG, the Strategic Business Plan of the department, and the budget process, as well as benchmarks and performance measures. We have not found many who could easily explain to us how all these fit together in a system.

It is important that reporting requirements not become a complex web of paperwork independent of useful and relevant policy making information. TPAB encourages the incoming Governor, the Director of OFM, legislative leaders, the Transportation Commission, and WSDOT to streamline and consolidate these requirements into a slim, clear, linear system and discard the remaining requirements that do not contribute to the system.

SUBSTANTIVE OBSERVATIONS

While this study was about the system, not the content of the performance measures, TPAB learned some things along the way that we believe should be called out. Those observations include:

Preservation

The power of good performance measurement data is perhaps shown no more clearly than in the information provided on pavement conditions. Attachment A to this letter contains the 4th quarter 2003 summary of pavement conditions from pages 39-41 of the December 31, 2003 Gray Notebook. (Available online at: http://ltc.leg.wa.gov/tpab/pmr_wsdot_hf/A-Pavement.pdf)

A portrait of significant progress from the early 1970's to the present is provided. However, a chronic 9% plus of total roadway miles are in "poor condition" compared to a legislative benchmark goal of zero. This summary draws particular attention to the deteriorating condition of the Interstate Highway lane miles, which were originally built with Portland Concrete Cement (PCC). As the report says, *"The PCC pavements are 13 percent of the lane miles, yet carry 23 percent of the traffic. PCC pavements have longer lives than other pavements, but are very costly to rehabilitate, not only in terms of construction money but also in traveler inconvenience from traffic restrictions when pavement work is performed, especially on the major high traffic corridors."*

Forthcoming replacement of these pavements will bring big challenges involving funding, engineering and traffic management during construction (see the discussion on PCC pavements later in this section). The state is fast approaching the need to reckon with this looming financial and traffic crisis in pavement management, a story that is not fully revealed by the generally positive picture conveyed by the recent annual surveys of "poor" condition pavements for the entire highway system."

What the report does not say is that statewide prioritization of preservation dollars has tended to export urban preservation dollars to the rural systems, a transfer that has been possible thanks to the long life of PCC pavements in the urban areas and the high revenue yields of the urban areas. A draft WSDOT chart illustrating that funding pattern is provided as Attachment B. (Available online at: http://ltc.leg.wa.gov/tpab/pmr_wsdot_hf/B-UrbanRural.pdf)

A critical policy issue for WSDOT's prioritization policies will be the inevitable funding competition as urban area PCC needs rise to the surface. This is made all the more evident as the original '05-'07 funding chart showed zero funding for PCC pavements. That was amended by the nickel package, but not sufficiently to solve the PCC problem. Two problems emerge. One, how did a generally good prioritization system yield a zero funding scenario for PCC preservation and how should that system be amended to avoid systematic exclusion of given pavement types? Second, given a funding climate in which new revenues are hard to come by, how should budgeting decisions be made so that critical PCC lane miles carrying 23% of the state's travel miles get the dollars they need without doing damage to other roadways?

What seems to be lacking here is an overall asset management funding system that takes into account the life-cycles of the various pavement types and structures and sets aside a preservation reserve fund to efficiently replace worn out assets. Without such a system it is impossible to determine the long-term financial impact of adding new assets to the system while underfunding preservation of existing assets. Such a system of funding is typical in

the utility industry and unheard of in the transportation industry. However, at least establishing the accounting system would provide policy information as to the advisability of adding new assets while existing assets are in need of replacement.

The Importance of Productivity Tools in Reducing Congestion

Peak hour congestion is an issue in several areas of the state and is especially pressing in Puget Sound. The large investments proposed for both highway capacity and transit system expansion can tend to overwhelm important smaller and cheaper tools which can be very helpful. The Gray Notebooks provide evidence of the importance of several of these tools.

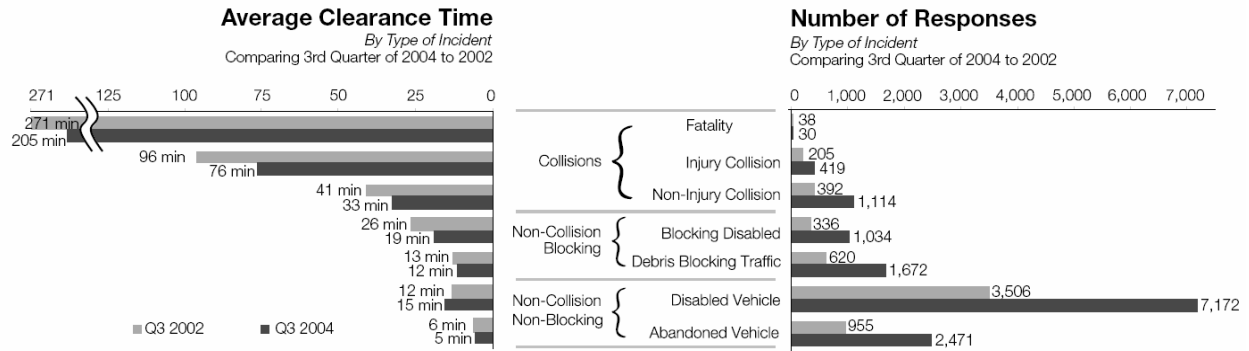
- Van Pools — Gray Notebook, Edition 15, p. 68, September 30, 2004: *"Increasing the number of vans on the road creates efficiencies because high occupancy vehicles reduce the number of vehicles traveling during peak traffic hours. Vanpool passenger miles as a share of total vehicle miles traveled (VMT) is an indicator of the magnitude of this effect. In the Puget Sound Region, vehicles travel nearly 80 million miles per day. Vanpool passenger miles are 0.8 percent of daily VMT, a relatively small percent. During both the morning and evening peak periods, vehicles travel slightly more than 14 million miles. During these peak travel times vanpool passenger miles represent 2.4 percent VMT. In the June 30, 2001 Gray Notebook, WSDOT noted that vanpool passenger miles represented nearly two percent of peak VMT in 1998. While VMT in the region has increased since 1998, vanpool passenger miles are increasing more rapidly. The significance of vanpooling is accentuated, as these vehicles typically travel on the major congested highways in the region.*

Another way to assess vanpooling's effect on system efficiency is to focus on congested corridors. There are 274 vans that operate on the I-405 corridor (20 percent of the vanpools operating in the region). These vehicles carry over 3,000 passengers each peak period."

- Incident Response Management — A significant amount of congestion is caused by roadway incidents ranging from abandoned vehicles to fatality collisions. In 2002, WSDOT and WSP adopted a joint performance goal, *"WSDOT and WSP will collaborate to respond to incidents and coordinate all public and private resources in this effort to work toward clearing incidents within 90 minutes."* Since then, significant progress has been made as illustrated in Gray Notebook, Edition 15, p. 58, September 30, 2004:

"Response Comparisons — 2002 and 2004

The chart below compares incident response types with average clearances times for July - September 2002 to July - September 2004. Since 2002, the number of responses has increased in all categories except fatal collisions (38 in quarter 3, 2002 and 30 in quarter 3, 2004). The least common types of incidents are the most time consuming to clear. Clearance times for all types of incidents have remained steady or decreased (the slight increase in the non-blocking disabled vehicle category is not part of an increasing trend over the two years.) During quarter 3, 2004 there were more disabled or abandoned vehicles on the roadside (i.e., not directly blocking travel lanes) than any other type of incidents. The charts categorize data in "primary" incident types only. All incidents are divided into these seven categories."



- **Ramp Metering** — Ramp metering has been installed in many locations to help improve the flow of traffic. A dramatic example of its effect on SR 520 was provided on p. 51 of the Sept. 30, 2004 Gray Notebook and is included in Attachment C. (Available online at: http://lrc.leg.wa.gov/tpab/pmr_wsdot_hf/C-RampMetering.pdf)
- **Spot Improvements** — Similarly, relatively inexpensive spot improvements can alleviate some bottlenecks. An example of a classic bottleneck was the awkward merger of Southbound I-405 traffic onto SR 167, the backup queue for which often extended hundreds of yards or longer back into the mainline of I-405, thus effectively turning a freeway lane into a parking lot. The before and after story for this improvement was told on p. 52 of the September 30, 2004 Gray Notebook and is also included in Attachment D. (Available online at: http://lrc.leg.wa.gov/tpab/pmr_wsdot_hf/D-SpotImprovements.pdf)

Safety

The March 2004 Gray Notebook, p. 30, reminds us of the profound importance of safety on our roadways. We lost 601 people in motor vehicle accidents in 2003. The estimated societal cost of all statewide accidents was \$5.6 billion in 2002, *"about \$930 for every man, woman and child in the state."* These would be staggering numbers standing alone, but they also represent a remarkable amount of progress and place Washington among the best states in terms of lowest number of vehicular deaths per capita. The 601 deaths continue a decline in motor vehicle fatalities that has been going on since the mid-1980's and represents the lowest number for a single year since 1961. But despite the progress, the deaths and the costs remain significant, reminding us that safety must remain a central consideration in transportation policy making.

Preservation, productivity, and safety are only a few of the many lessons available from the performance measures in the Gray Notebook. As these efforts evolve and mature they will provide an unavoidable source of data for policy makers trying to improve Washington's transportation system.

Asset Management: Pavement Assessment Annual Update

WSDOT maintains approximately 19,200 lane miles (including ramps) of pavement surfaces. The three major pavement types are chip seal, hot mix asphalt pavement, and portland cement concrete (PCC) pavement. Each of these pavement types has an associated pavement life, rehabilitation treatment, and rehabilitation cost. This report is an annual update of information last presented in the *Gray Notebook* for the quarter ending December 31, 2002.

Pavement Condition Update, 2002 Results

According to the 2002 pavement condition survey, the percent of WSDOT pavements in "poor" condition increased slightly in 2002 to 9.3 percent, up from 8.9 percent as reported in the 2001 pavement survey. The rating continues to be dramatically better, however, than the situation in 1971 when the Washington State Pavement Management System was first put in place.

Programming Pavements for Rehabilitation

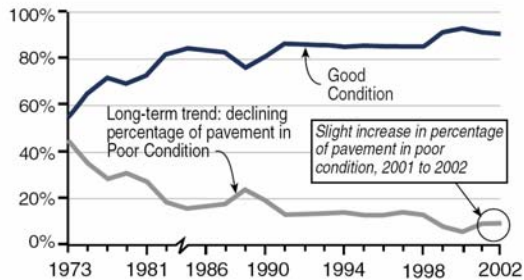
The table below shows some important facts about the extent and use of the various pavement types, and the success that the state seems to be achieving in directing investment to areas of need.

Over the last biennium, about nine percent of pavement rehabilitation spending has been for chip seal resurfacing. These roads, the cheapest to resurface, constitute about 23 percent of the lane miles but carry only about five percent of the traffic.

Eighty-eight percent of the spending has been for preservation of hot mix asphalt pavements. These roads are 64 percent of the lane miles and carry 71 percent of the traffic.

The PCC pavements are 13 percent of the lane miles, yet carry 23 percent of the traffic. PCC pavements have longer lives than other pavements, but are very costly to rehabilitate, not only in terms of construction money but also in traveler inconvenience from traffic restrictions when pavement work is performed, especially on the major high-traffic corridors. Forthcoming replacement of these pavements will bring big challenges involving funding, engineering and traffic management during construction (see the discussion on PCC pavements later in this section). The state is fast approaching the need to reckon with this looming financial and traffic crisis in pavement management, a story that is not fully revealed by the generally positive picture conveyed by the recent annual surveys of "poor" condition pavements for the entire highway system.

Pavement Condition Trends
Percent of Pavements



Source: WSDOT Materials Lab.

Lowest Life Cycle Cost (LLCC) Program for Pavement Management

The basic principles behind LLCC are rather simple — if rehabilitation is done too early, pavement life is wasted, if rehabilitation is done too late, very costly repair work may be required, especially if the underlying structure is compromised. WSDOT continually looks for ways to best strike a balance between these two basic principles while implementing the practical aspects of pavement rehabilitation programs.

Pavement Type	Lane Miles	% Lane Miles	Annual Vehicle Miles Traveled - 2002 (in billions)		03-05 Dollars Programmed (in millions)		05-07 Dollars Programmed (in millions)	
			Miles	%	\$	%	\$	%
Chip Seal Pavements A chip seal is a durable surface that provides six to eight years of performance life and has an approximate cost of \$12,000 per lane mile.	4,490	23.4%	1.7	5.3%	\$19.5	9%	\$18.2	9%
Hot Mix Asphalt Pavements Hot mix asphalt pavement surface life between rehabilitation treatments can range from six to 18 years (based on actual pavement performance) and has a cost of \$123,000 (due miles) per lane mile, and \$156,000 (past due miles) per lane mile.	12,284	64.0%	22.5	71.5%	\$181.9	84%	\$184.5	91%
Portland Cement Concrete (PCC) Pavements WSDOT has experienced PCC pavement lives ranging from 25 to 45 years and has an approximate cost of \$330,000 for dowel bar retrofit per lane mile and \$1 million for full replacement per lane mile.	2,410	12.6%	7.3	23.3%	\$14.2	7%	\$0	0%

Source: WSDOT Systems Analysis and Program Development Office, WSDOT Materials Lab.

Chip Seals

For chip seals, asphalt is sprayed on the existing surface and then covered with a layer of rock chips. The oil becomes solid as it cools. Chip seals are appropriate for low volume roads (less than 2,000 vehicles per day and less than approximately 200 trucks per day). Since the roadways that receive this type of treatment are typically on rural routes, WSDOT has found that pavement rehabilitation dollars seem to be best spent with efficiency of scale when a stretch of rural road mileage is taken together for resurfacing in a single “paver” contract even when the contract includes aging segments not yet “due” together with “past due” segments.



Hot Mix Asphalt

On average, western Washington hot mix asphalt pavement life is 16.5 years, eastern Washington life is 11.3 years (due to severe winter cold and extreme summer heat), and the statewide average is 14.7 years. Hot mix asphalt is appropriate for a broad range of roadways, from lower volume routes (more than 2,000 vehicles per day and more than 200 trucks per day) to interstates with heavy traffic volumes.



These pavements are where the greatest benefits of LLCC pavement management can be realized. In past biennia, there has been some tendency to allocate a share of pavement preservation dollars on a traditional basis by region in addition to dollars programmed strictly by reference to “past due” needs. This has resulted in some distortion away from ideal LLCC results. As of the 2003-05 biennium, this has been corrected by making all regional allocations based on pavement condition and LLCC analysis.

Portland Cement Concrete (PCC)

Existing PCC pavement life ranges from 25 to 45 years. PCC pavement is typically placed on heavily traveled interstate, principal arterial and intersection locations. Most of the PCC pavements historically installed on Washington highways require dowel bar retrofit and diamond grinding (to smooth the pavement surface) 20 to 25 years after construction (due to lack of reinforcing steel at the transverse joints to prevent settlement). It is estimated that a newly constructed PCC pavement will have a pavement life of 50 years and only require diamond grinding in its 25th year due to studded tire wear.

Efficiency Gains for Hot Mix Asphalt Pavements

Hot mix asphalt surface life has improved by 14 percent (statewide) over the last six years, while over the same time period the vehicle miles traveled on asphalt paved roadways has increased by approximately 10 percent. Management of asphalt pavements is an area where WSDOT has succeeded in delivering dramatically improved “bang for the buck” to Washington state taxpayers.

How have WSDOT and its asphalt paving industry contractors achieved this significant efficiency gain in asphalt on state freeways and highways? The keys lie chiefly in the following areas:

- Provision on the paving specification for use of performance-grade binders selected for expected climate and traffic conditions;
- Use of Superpave mix designs keyed to temperature and traffic expectations;
- Improved asphalt pavement repair and asphalt placement techniques;
- Better attention to construction details and inspection, and,
- Increased experience with LLCC rehabilitation programming.

WSDOT is also focusing pavement management efforts on programming more lane miles at a single location, resulting in lower bid prices. The amount of asphalt used for pre-leveling (filling in minor ruts and depressions prior to paving) has also been reduced on WSDOT paving jobs, generally from 600 tons per lane mile to 300 tons per lane mile, resulting in a substantial cost savings. The effect of these efficiency gains, taken together, is that a tax dollar invested in pavement rehabilitation today buys much more than it did just a few years ago.

2004 Concrete Lane Miles*		
Current Age (Construction or Reconstruction)	Total Lane Miles	Lane Miles Rehabilitated to Date by Dowel Bar Retrofit
0-10	147.1	0.0
11-20	274.0	0.0
21-30	566.8	35.0
31-40	642.0	322.4
41-50	279.1	58.1
51-60	5.0	0.2
61 or more	66.1	0.0
Total	1980.0	415.7

* Does not include 321 lane miles of bridge sections and 112 lane miles of ramps.

A matter of concern in the 2002 pavement condition survey is that an additional six miles of PCC pavement were found to have fallen into the “poor” category, raising the PCC “poor” total to 170 lane miles. However, the greatest concern is the potential for a dramatic increase in the poor category as a result of the PCC performance reevaluation in 2004.

The table at left illustrates the number of PCC pavement lane miles currently owned and maintained by WSDOT. Sixty miles of PCC replacement would cost on the order of approximately \$60 million *before* taking into account the project costs associated with roadway safety upgrades and stormwater runoff control retrofits. Traffic disruptions associated with rehabilitation or replacement of these pavements is another difficult feature of this looming problem.



Rating Pavement Conditions

WSDOT continues to use a three-part examination system to rate pavement condition:



Pavement Structural Condition (PSC)

A pavement will develop structural deficiencies for two reasons: truck traffic and cold weather. The PSC is a measure based on distress, such as cracking and patching, which are related to the pavement's ability to carry loads. PSC ranges from 100 (best condition) to 0 (worst condition). A roadway should be considered for rehabilitation when it falls within the PSC range of 40 to 60.



Rutting

Rutting is caused by heavy truck traffic or studded tire wear. Ruts deeper than 1/2 inch have the potential to hold water, increasing the risk of hydroplaning for high-speed traffic. A roadway should be rehabilitated when the rut depth is greater than 1/3 inch.



Roughness

The International Roughness Index (IRI) is a procedure to measure pavement ride. A full-sized van, with a laser-measuring device mounted on the front bumper, measures the roughness of the pavement. A roadway should be rehabilitated when the IRI value is between 170 and 220 inches per mile.

Determining When Pavements are "Due"

The Pavement Condition Rating process using the van pictured on the right analyzes and predicts the pavement rehabilitation due period (see the *Gray Notebook* for the quarter ending June 30, 2001 for details). A regional validation process reviews the results and calibrates the ratings if needed. The number of disputed segments varies between 5-10%. Each of the segments in question is then reviewed and any discrepancies are resolved. WSDOT considers the pavement rehabilitation due year in the Pavement Management System to be approaching 100% accuracy.



Pavement Condition Data Collection Vehicle

How Do Washington's Pavements Conditions Compare with National Experience?

FHWA's annual *Highway Statistics* report includes information on pavement condition reported by each of the 50 states and the District of Columbia (based on roughness only). To the right is a snapshot of the 2002 results that shows the number of miles, by state, in poor condition according to smoothness. The total miles reported includes the interstate system and principal arterials owned by the state, cities, and counties, and a sampling of other functional classes. Washington state ranked 16th in smooth roads in 2002 (Washington was ranked 17th in 2001).

The FHWA publication can be viewed at www.fhwa.dot.gov/policy/ohim/hs02/index.htm.

2002 Pavement Smoothness by State

Rank	State	Centerline Miles Reported	Miles in Poor Condition	Percent in Poor Condition
1	Georgia	11,301	34	0.3%
2	Wyoming	4,414	22	0.5%
3	Alabama	7,643	41	0.5%
4	North Dakota	6,180	53	0.9%
5	Minnesota	11,658	108	0.9%
6	Nevada	2,959	33	1.1%
7	Kentucky	5,192	76	1.5%
8	Florida	10,898	160	1.5%
9	Kansas	8,851	183	2.1%
10	Arizona	4,065	86	2.1%
11	Idaho	3,860	93	2.4%
12	Maine	2,391	60	2.5%
13	Montana	6,927	179	2.6%
14	Utah	3,676	120	3.3%
15	Alaska	1,800	62	3.4%
16	Washington	5,396	194	3.6%
17	South Carolina	6,791	260	3.8%
18	New Hampshire	1,375	54	3.9%
49	California	20,634	5,437	26.3%
50	Massachusetts	3,290	1,182	35.9%

Source: Highway Statistics 2002, U.S. Department of Transportation

Attachment B

Return Per Dollar Contributed by Citizens Within Each Region Total Historical State & Federal Transportation Funding 1984-2003



Urban Areas	Funding Contributed for Transportation	Transportation Distributions & Expenditures	Return Per Dollar Contributed
Puget Sound ¹	13,375,363,000	13,173,740,000	0.98
Remaining Puget Sound ²	2,232,262,000	2,400,784,000	1.08
Vancouver Urban Area ³	1,278,312,000	948,129,000	0.74
Yakima Urban Area ⁴	850,069,000	628,581,000	0.74
Tri-Cities Urban Area ⁵	862,338,000	769,619,000	0.89
Spokane Urban Area ⁶	1,726,267,000	1,276,224,000	0.74
Bellingham Urban Area ⁷	798,811,000	487,586,000	0.61
Remainder of State	4,990,332,000	7,596,154,000	1.52
Total State	26,113,754,000	27,280,817,000	1.04

¹Puget Sound consists of King, Pierce and Snohomish Counties.

²Remaining Puget Sound consists of Kitsap and Thurston Counties.

³Vancouver Urban Area consists of Clark County.

⁴Yakima Urban Area consists of Yakima County.

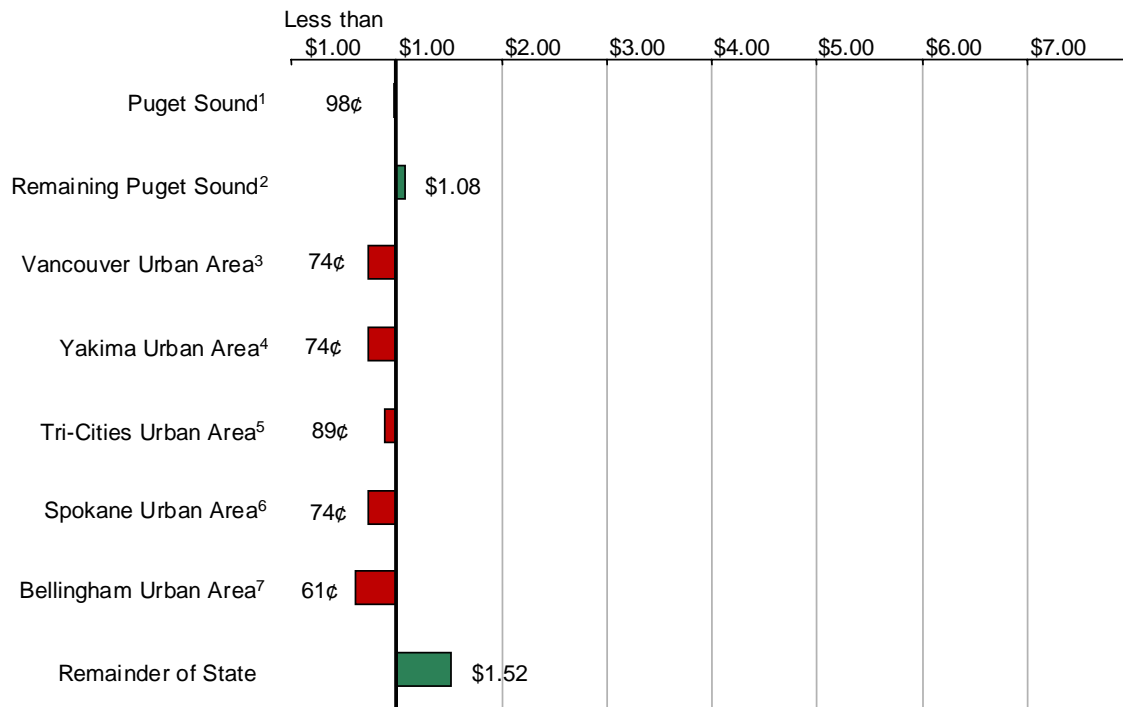
⁵Tri-Cities Urban Area Consists of Benton and Franklin Counties.

⁶Spokane Urban Area consists of Spokane County.

⁷Bellingham Urban Area consists of Whatcom County.

Note: Transportation funds include associated bond proceeds but are net of debt service expenditures.
This chart does not include locally imposed taxes by counties, cities, or transit agencies for transportation purposes.

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Measuring Delay and Congestion: Annual Update

Case Studies – Before and After Results

Case Study 1 - Ramp Metering

Smoother Merging, More Throughput, and Higher Speeds

Reducing highway traffic congestion is the primary goal of ramp metering. Ramp meters respond to actual traffic conditions, linking computers with sensors embedded in the ramps and on the freeways near the ramps. These act as metal detectors, registering when a car or motorcycle passes over the sensor. This information is fed to a central computer, that in turn adjusts the rate at which the ramp meter signal releases drivers to enter the mainline. If cars start to back up onto the city street, the ramp meter automatically speeds up to clear the

queue. If traffic is light on the highway, the meter also speeds up to allow more cars to merge. If traffic is heavy everywhere, which is often the case during peak hours, the computer optimizes the flow. Ramp meters help smooth traffic flow. The Transportation Management Center in Seattle monitors over 150 freeway ramp meters, and one in Vancouver, during congested hours on all days. Ramp metering reduces congestion while increasing throughput and freeway speeds.

How do we know ramp meters reduce congestion?

The following chart shows traffic conditions on SR 520 between I-5 and the floating bridge on a typical morning (July 25, 2001) without ramp metering.

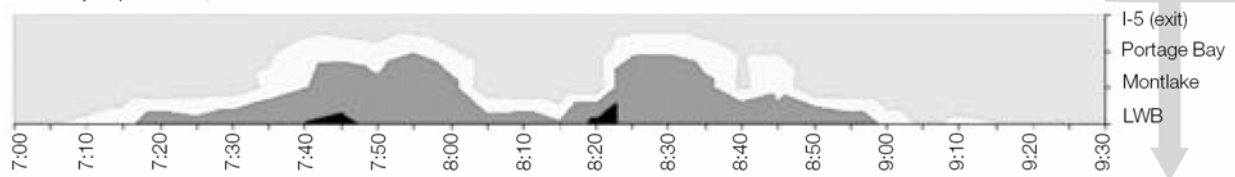
Before Ramp Metering:

SR 520 Eastbound Morning Congestion, I-5 (exit to SR 520) to Lake Washington Blvd. (LWB)
Wednesday July 25, 2001



After Ramp Metering:

SR 520 Eastbound Morning Congestion, I-5 (exit to SR 520) to Lake Washington Blvd. (LWB)
Thursday September 6, 2001



Wide Open Moderate Heavy Stop and Go

Source: WSDOT NWR Traffic Operations

Before

Reading the top graph, the black shading shows stop-and-go traffic from 7:30 a.m. to 9:30 a.m., extending back to I-5 at different times. At 8:00 a.m. on this day, traffic flow on SR 520 eastbound was at a rate of 2,780 vehicles per hour.

After

The bottom graph shows a typical morning (Sept. 6, 2001) after ramp metering was activated along the corridor. Stop-and-go traffic was limited to a total duration of about 15 minutes and never extended west of Montlake Blvd. NE. At 8:00 a.m. on this day, traffic flow on SR 520 was at a rate of 3,265 vehicles per hour.

Measuring Delay and Congestion: Annual Update

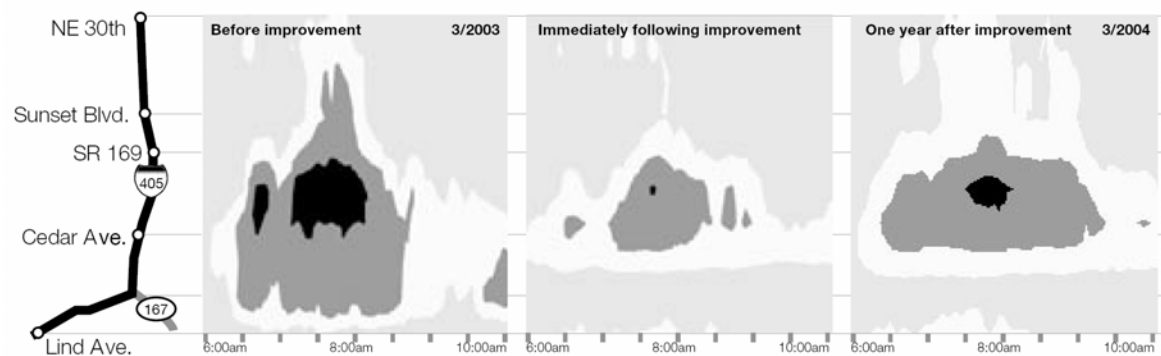
Case Study 2 - I-405/SR 167 Ramp Separation Project

Spot Capacity Improvement

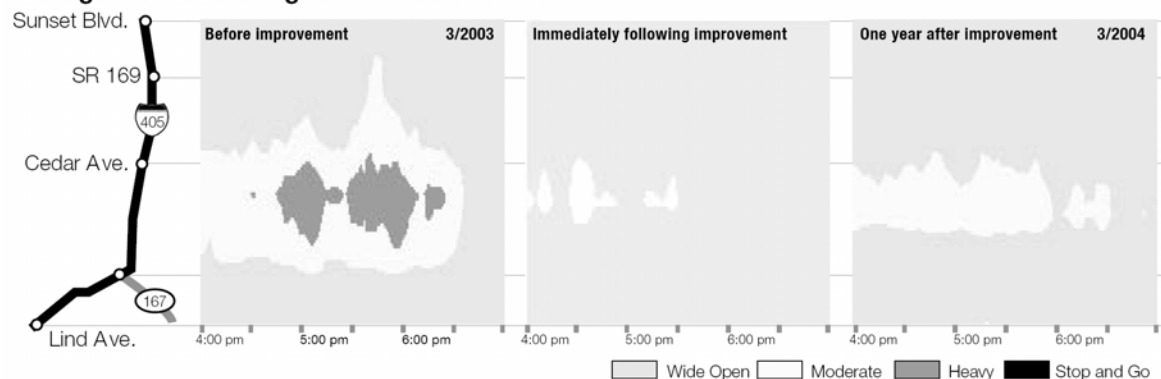
The March 2003 *Gray Notebook* published an evaluation several weeks after the opening of the I-405 / SR 167 Ramp Separation (flyover ramp) project in Renton that showed, for the short-term, a significant reduction in congestion and delay. No one was sure, however, whether the improvement would be sustained as drivers adjusted to the new situation.

WSDOT now has "one year later" data to compare with the "before" and the "shortly after" data earlier shown. The results are very encouraging in that the delay relief benefits from the improvement have in fact been sustained. These comparisons shown below, first for the weekday situation and second for the weekend situation, are particularly noteworthy because in the March 2003 to March 2004 period, the daytime volumes on I-405 increased by 3.6 percent, and on SR 167 increased by 5.3 percent. On weekends, I-405 traffic volumes have increased about 10 percent.

Average Weekday Congestion I-405 Southbound



Average Weekend Congestion I-405 Southbound



Source: WSDOT NWR Traffic Operations